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ABSTRACT

Designed as part of a 40-hour course in minor electrical home repairs, this 50-minute lesson is designed to enable the student to: (1) use a voltage tester to isolate electrical switching problems safely; (2) use simple hand tools to remove the defective switch without creating a shock hazard; (3) correctly identify the type of wire, current, voltage rating, and amperage limitation for the new switch from the information found on the defective switch; (4) use a continuity tester to test the new switch for proper operation before installation; and (5) install the new switch legally and test the circuit safely. The lesson plan includes information on the course for which the lesson was desinged; equipment and audiovisual aids needed; requirements for student materials; course objectives; bibliographic references; and special remarks for the instructor. Next, a step-by-step outline of the instructor's presentation is provided in a format indicating the length of time and the equipment or other aids necessary for each step of the lesson. Transparency masters are included. (PAA)

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REPLACING A SINGLE-POLE LIGHT SWITCH

Minor Electrical Home Repairs,
Lesson Plan No. 3

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LESSON PLAN

LESSON PLAN NO.	INSTITUTION / AGENCY:	PAGE 1 OF 20 PAGES
3	Western Curriculum Coordination Center	

COURSE OF INSTRUCTION AND COURSE NUMBER:	TOTAL HOURS:	LESSON TITLE:
Minor Electrical Home Repairs (Elec. 60)	40 Hrs.	Replacing a Single Pole Light Switch

DAY AND DATE OF INSTRUCTION:	HOURS	PLACE:
Thursday, November 13, 1986	5:00 - 5:50 PM	University of Hawaii-Manoa, Rm. 112 Wist Hall

NO. OF STUDENTS:	REHEARSAL:	INSTRUCTOR AND ASSISTANTS:	STUDENT MATERIALS AND DRESS:
6	Nov. 1 & 2 1986	Kawamura, Harry T.	Casual Clothing with Covered Shoes

REFERENCES:

See Page 2

EQUIPMENT AND AUDIO-VISUAL AIDS:

1. Mock-up of single pole switching circuit. (See page 13)
2. Overhead projector.
3. Screen.
4. Colored chalk.
5. Small hand tools: Common screwdriver, knife, diagonal plier, long nose plier.
6. Continuity tester.
7. Voltage tester.
8. Assorted single pole switches.
9. Seven transparencies: types of switches (TM #1), type of wiring (TM #2), using voltage tester (TM #3), Terminating wires (TM #4), back wired (TM #5), switch information (TM #6), continuity tester (TM #7).

OBJECTIVES:

See Page 4

SPECIAL REMARKS:

Class comprised of home owners with very little knowledge of electricity.

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS

REFERENCES:

Miller, Rex, Residential Electrical Wiring Peoria, Illinois Bennett Publishing Company, 1981, pp. 174-182.

Graf, Rudolf F. and Whalen, George J., Home Wiring Englewood Cliffs, New Jersey Prentice-Hall, Inc. 1982, pp. 132-145.

Whitney, William J., Electrical Wiring: Residential New York, New York John Wiley & Sons, 1979, pp. 46-53.

Editors, Time-Life Books, Basic Wiring Alexandria, Virginia Time-Life Books, 1980, pp. 40-45.

LESSON PLAN NO. 3

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
A. INTRODUCTION How many of you can afford to throw away _____ dollars. That's what you will be doing if you have to call an electrician to replace a defective switch in your home. Failure of electrical switches are the second most common problem you will encounter with the electrical circuits in your home. The first being light bulb failure. Today you will learn how to save that _____ dollars. The City & County of Honolulu allows a home owner to do minor electrical repairs to maintain his/her own home, but you would still need a qualified electrician if you want to replace old wiring or add new electrical circuits. 1. Goal ---- Today you will learn: To identify a defective single pole light switch and safely replace it.	11 min.	Lecture Show $50 or $100 bill

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
2. Objectives ---- After this lesson you will be able to: a. Use a voltage tester to isolate electrical switching problems without endangering yourself or damaging your property. b. Use simple hand tools to remove the defective switch without creating a shock hazard. c. Correctly identify the type of wire, current, voltage rating and amperage limitation for the new switch from the information found on the defective switch. d. Use a continuity tester to test the new switch for proper operation before installation. e. Install the new switch and test the circuit without violating any safety procedures which may endanger your family or your property.		

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
3. Reasons a. This lesson will give you more confidence when working with electricity. You will learn what your limitations are---and when you need help from a qualified electrician. b. Being able to isolate electrical switching problems, will make you more knowledgeable about electrical circuits. You will be able to apply this knowledge on other electrical circuits such as disposal circuits, water heater circuits, table lamps, etc.. c. Remember, learning to replace your own defective switches will save you money. 4. Procedure a. Identify the types of switches most commonly found in today's homes. b. Isolate electrical switching problems. c. Remove defective switch. d. Gather pertinent information for new switch. e. Test new switch before installation. f. Install new switch and test.		

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
B. EXPLANATION/DEMONSTRATION Before we learn how to replace any electrical switch in a home, we must first learn how to differentiate between the many different types of electrical switches found in a home. 1. The types of switches most commonly found in today's homes are: (TM #1) a. Single pole switch 1. Has two terminal screws. 2. Has an "off" and "on" position. 3. It is used to control a light from one location. 4. Ask students to give example of where these switches may be used. Question: Where would you find a single pole switch in your home? Possible Answers: kitchen, bedroom, bathroom, den or any room with only one entrance. b. Three-way switch 1. Has three terminal screws. 2. Has no "off" or "on" position. 3. It is used to control a light from two locations. 4. It must be used in pairs. 5. Ask students to give example of where these switches may be used.	30 min.	Demonstration Teaching Aids: Transparency #1

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
Question: Where would you find a three-way switch in your home? Possible Answers: long hallways, between the garage and house, kitchen or any room with two entrances. c. Four-way switch 1. Has four terminal screws. 2. Has no "off" or "on" position. 3. It is used to control a light from three or more locations. 4. It must be used with two (2) three-way switches. d. Double pole switch 1. Has four terminal screws. 2. Has an "off" and "on" position. 3. It is used to control two lines at the same time (e.g., 220v water heater). As I stated before, our goal for today will be to identify and replace a defective single pole switch. The other switches will be covered in the upcoming lessons. If a light doesn't work, check the light bulb, and the circuit breaker or fuse. Then retest the lighting circuit. If the light still does not work, then you check the switch. 2. Using a voltage tester, isolate electrical switching problem without endangering yourself or damaging your property.		Teaching Aids: Mock-up Teaching Aids: Voltage tester Small hand tools

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
a. Remove face plate of the switch---being careful not to damage painted surfaces.		
b. Locate position of the terminal screws of the switch. (TM #2) If terminal screws are not accessible, disconnect power by turning "off" the circuit breaker or removing the fuse.		Transparency #2
c. Remove the switch from the box. Be sure that the switch is in the "off" position then turn the power back "on".		
d. Using voltage tester. (TM #3) Take the voltage tester, place one lead on one of the terminal screw on the switch and the other lead on the box (if grounded -- explain) or on the ground wire (bare or green in color). If the box is not grounded and there is no ground wire present hold the lead in your hand. Be sure you are not grounded when you do this or you will receive a slight shock. Explain how to isolate oneself from ground. Call on student volunteer to do this to show others that, if done correctly, there is no danger to oneself.		Transparency #3
e. If power is present, the tester will light up. If the tester does not light up move the test lead to the other terminal screw and repeat the testing procedure. Explain location of incoming power on single pole switches (color of screws).		
f. If power is not present, check to see if circuit breaker is really in the "on" position (explain how this is done).		

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
g. If power is present, move the handle to the "on" position and repeat the testing procedure. The tester should light up if the the switch is working properly.		
h. If the switch is defective, replace it. Call a qualified electrician if you cannot find the problem or if there is no power present.		
3. Using simple hand tools remove the defective switch without creating a shock hazard for yourself.		Teaching Aids: Small hand tools
Ask students what they would do first before removing switch.		
a. Turn "off" the circuit breaker or remove the fuse before starting.		
b. Label the wires, loosen terminal screws and remove wires. Be careful to use a proper size screwdriver. (TM #4)		Transparency #4
c. If back wired, show students how to remove the wires. (TM #5) (e.g., paper clip, piece of wire, small screwdriver)		Transparency #5
4. From information found on the defective switch correctly identify information needed to purchase the new switch.		Teaching Aids: Assorted switches
a. Distribute switches to students and have them give you information that they think they need to purchase the right switch. List responses on the chalkboard. Do this before showing transparency.		

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
b. Using TM #6, discuss the following:		Transparency #6
1. Importance of Underwriters Laboratory (UL) label on electrical products. a. Consumer safety		
2. Designations for copper and aluminum wires. a. Effects of contact of two dissimilar metals. (galvanic action)		
3. Importance of correct voltage and current. a. Amount of voltage and type of current it can carry safely without causing an unsafe condition.		
4. Importance of amperage rating. a. Amount of current it can carry safely without overheating or causing an unsafe condition.		
5. Using a continuity tester, check the new switch for proper operation before installation.		Teaching Aids: Continuity tester
a. Touch the two leads together, if the battery is charged the light within the tester will light up.		
b. With the switch in the "off" position, place leads of continuity tester on terminal screws then turn the switch 'off' and "on" several times. The light should come on every time the switch is in the "on" position. (TM #7)		Transparency #7
c. Have students test switches that were distributed.		
6. Install new switch and test the lighting circuit without violating any safety procedures which may endanger lives or property.		Teaching Aids: Single pole switch Small hand tools

PRESENTATION

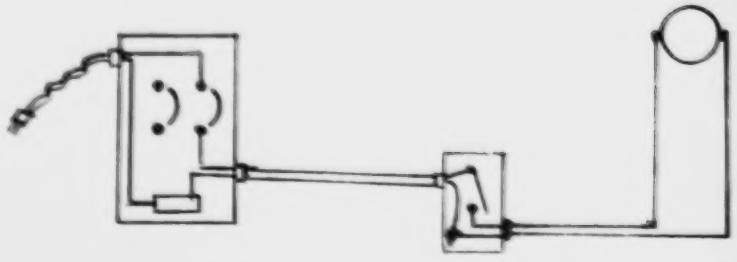
OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
a. Double check lighting circuit to make sure that the power is "off". (circuit breaker or fuse)		
b. Make a loop on the wires, check your markings and install the wires on the terminal screws so that the loop is in a clockwise direction (TM #4). Explain why it must be in a clockwise direction.		Transparency #4
c. Be sure that the wire is completely under the terminal screw and that the exposed part of the wire is within the body of the switch before tightening the screws (more exposed parts greater chances of short circuits). Tighten terminal screws so that the wire does not move under the screw, but do not over tighten the terminal screws. You may break the plastic body of the switch.		
d. If switch is back wired (TM #5), use the strip gauge on the back of the switch to get the proper length, then insert the wire. Pull on wire to test if it was installed properly. Use a knife or a wire stripper for this demonstration.		Transparency #5
e. Fold the wires in an "S" shape then install the switch into the box so you can read the word "off" on the handle. Take care not to damage the wires, wall or switch. Also be sure that the switch is mounted plumb.		
f. Replace the face plate.		
g. Turn circuit breaker back "on" or replace the fuse. Test the lighting circuit for proper operation.		

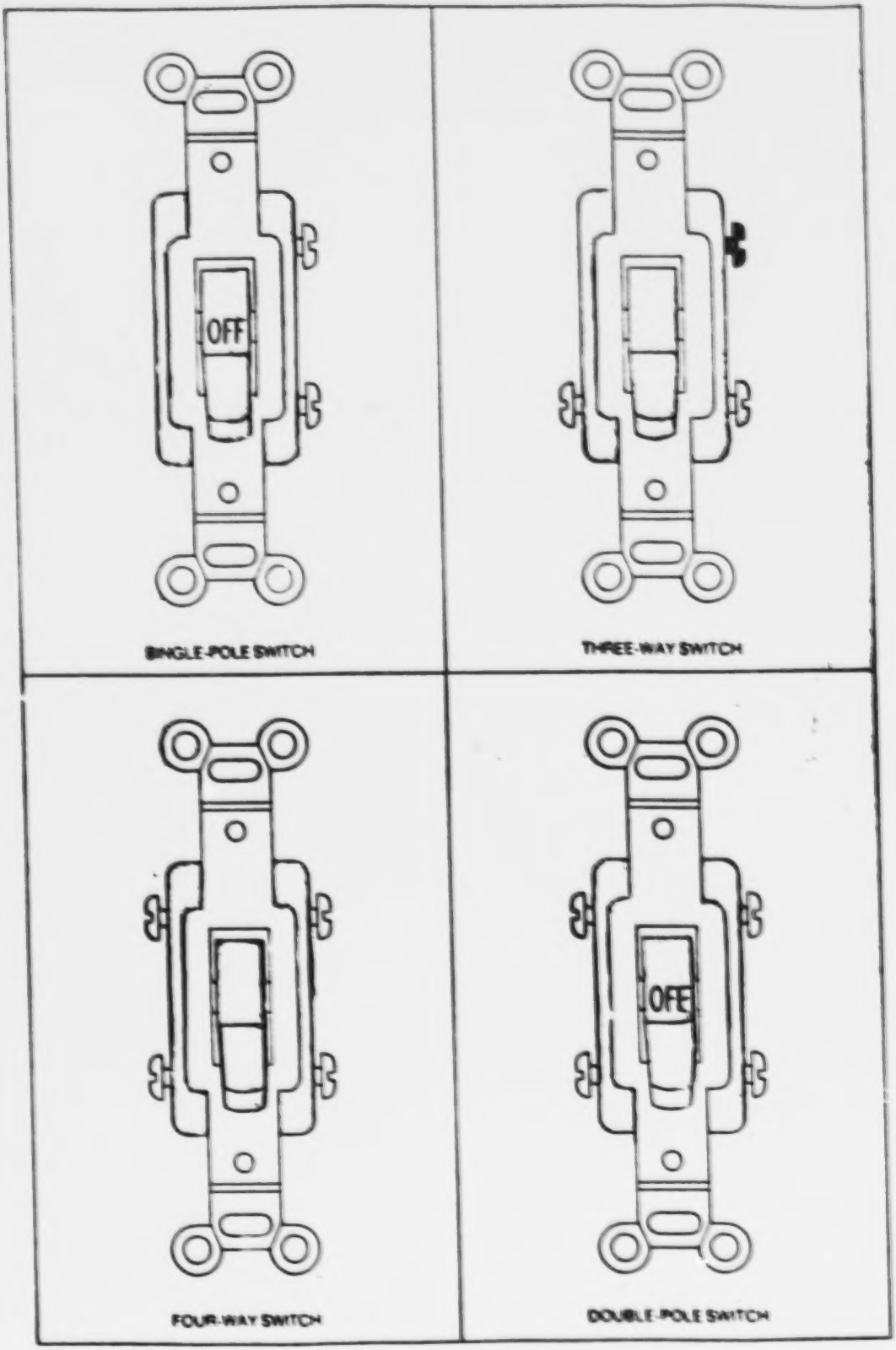
PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
C. SUMMARY	9 min.	Lecture
1. If time permits, have students repeat the procedures for identifying a defective single pole switch and the procedures to replace it. (Need approximately 15 min.)		Teaching Aids: Mock-up
2. If there is not enough time for student participation, do a quick summary.		
a. After checking light bulb, circuit breaker or fuse, isolate switching problem with voltage tester.		
b. If switch is defective, remove switch using a screwdriver and a diaganol cutting plier. Be sure power is off before removing switch.		
c. Gather information from defective switch, such as voltage rating, type of wire, type of current and amperage limitations. Always check for the UL label when purchasing the single pole switch.		Transparency #6
d. When rewiring the switch, be sure that the loop around the terminal screw is in the clockwise direction and that the exposed part of the wire is within the body of the switch before tightening the screw. Do not over tighten the screw.		Transparency #4
e. Fold the wires in a "S" shape then install the switch in the box. Be careful not to damage the wires.		
f. Know your limitations. Electricity can kill. When in doubt, call a qualified electrician. It is not worth being killed or injured for _____ dollars.		

MATERIALS:

1	Two circuit panel box
1	15 amp circuit breaker
1	Single gang switch box (flush mounted, metal)
1	Single pole switch
1	Single gang switch face plate
1	4" round light box (flush mounted, plastic)
1	Keyless light fixture
1	25 watt light bulb
15'	14-2 cable with ground
2'	16-3 S.O. cord
1	Plug cap
3	Romax connector
1	2' x 3' 1/2" plywood

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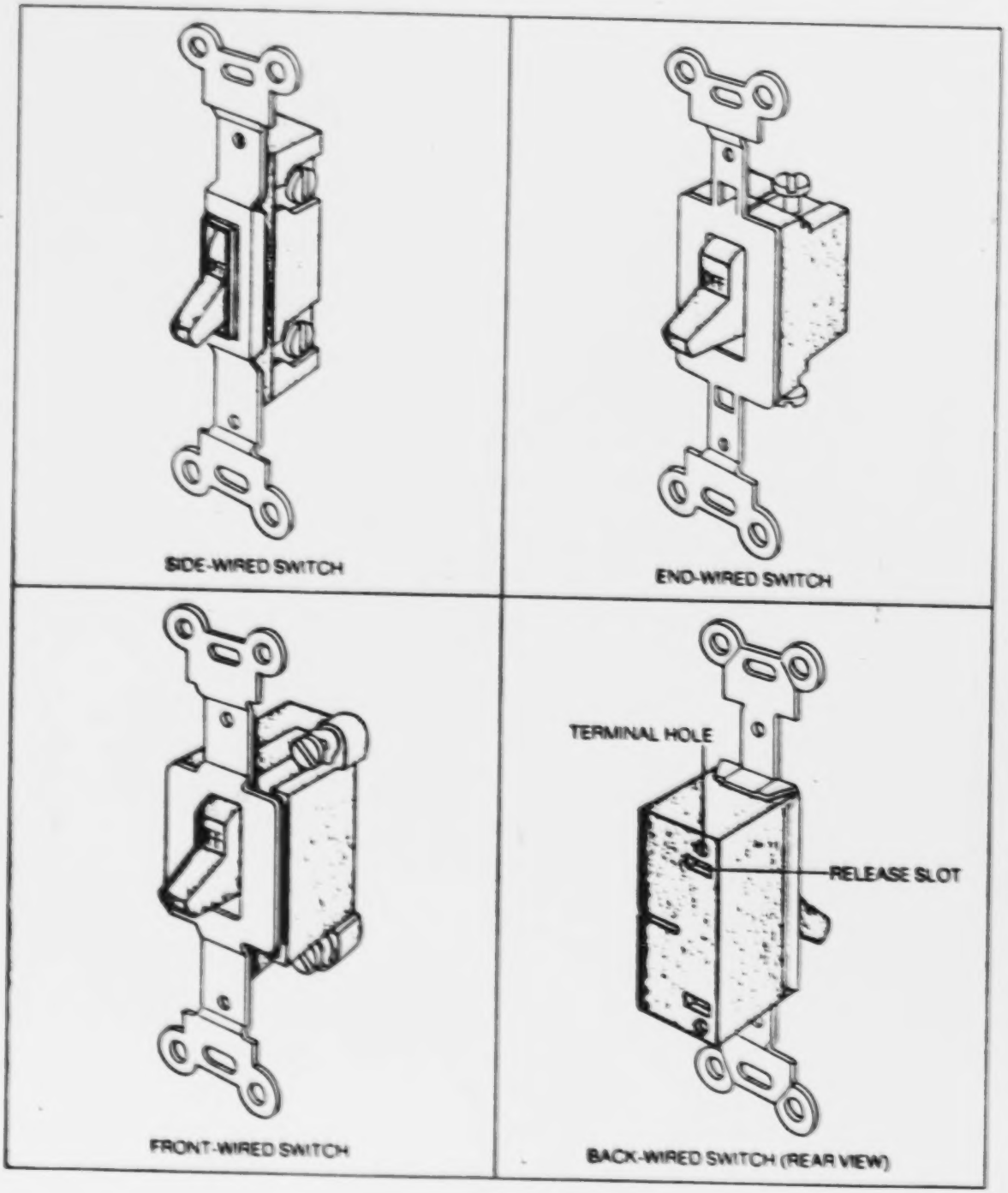
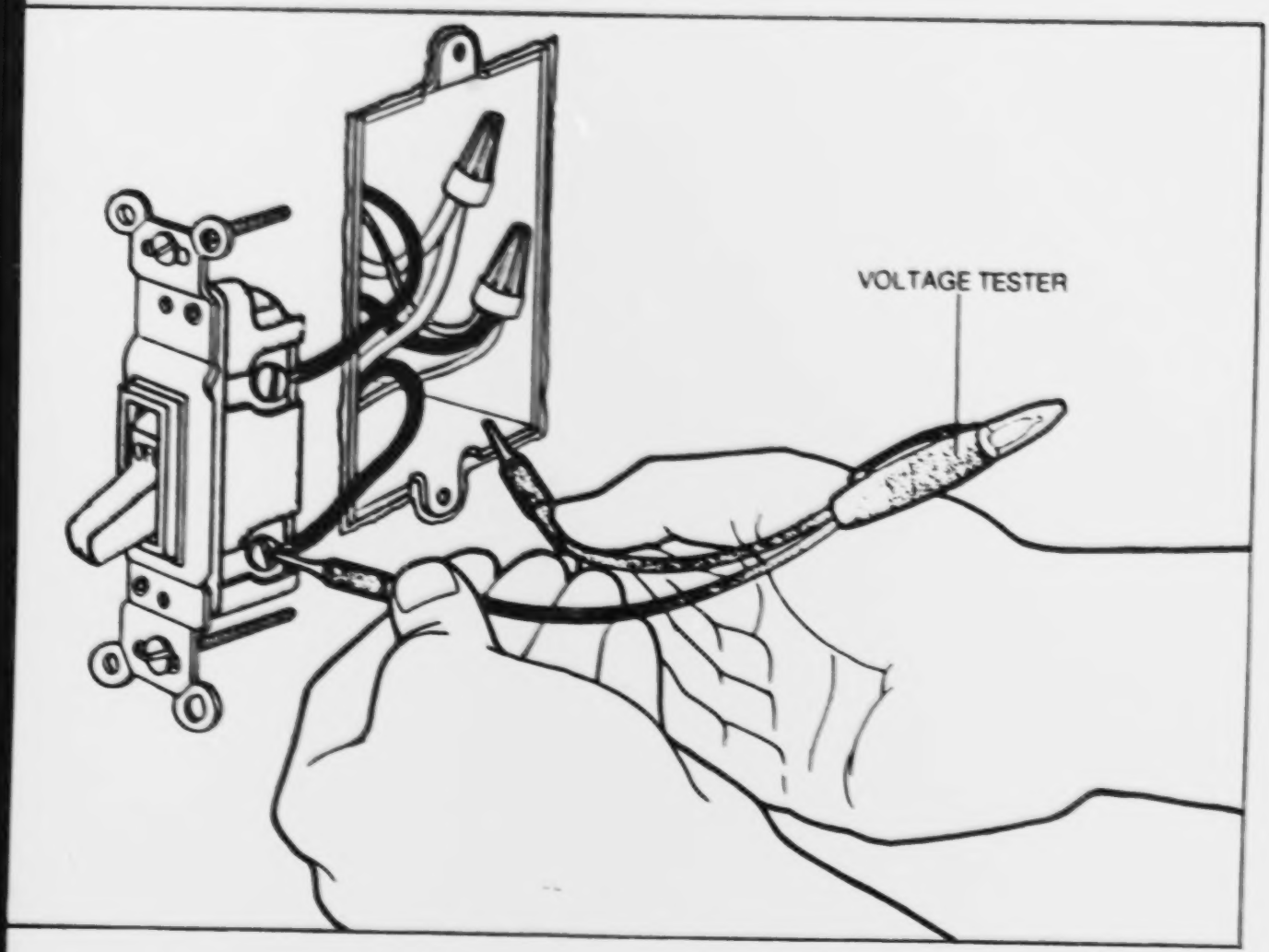
THREE-WAY SWITCH
FOUR-WAY SWITCH
OFF
DOUBLE-POLE SWITCH


SIDE-WIRED SWITCH
END-WIRED SWITCH
FRONT-WIRED SWITCH
TERMINAL HOLE
RELEASE SLOT
BACK-WIRED SWITCH (REAR VIEW)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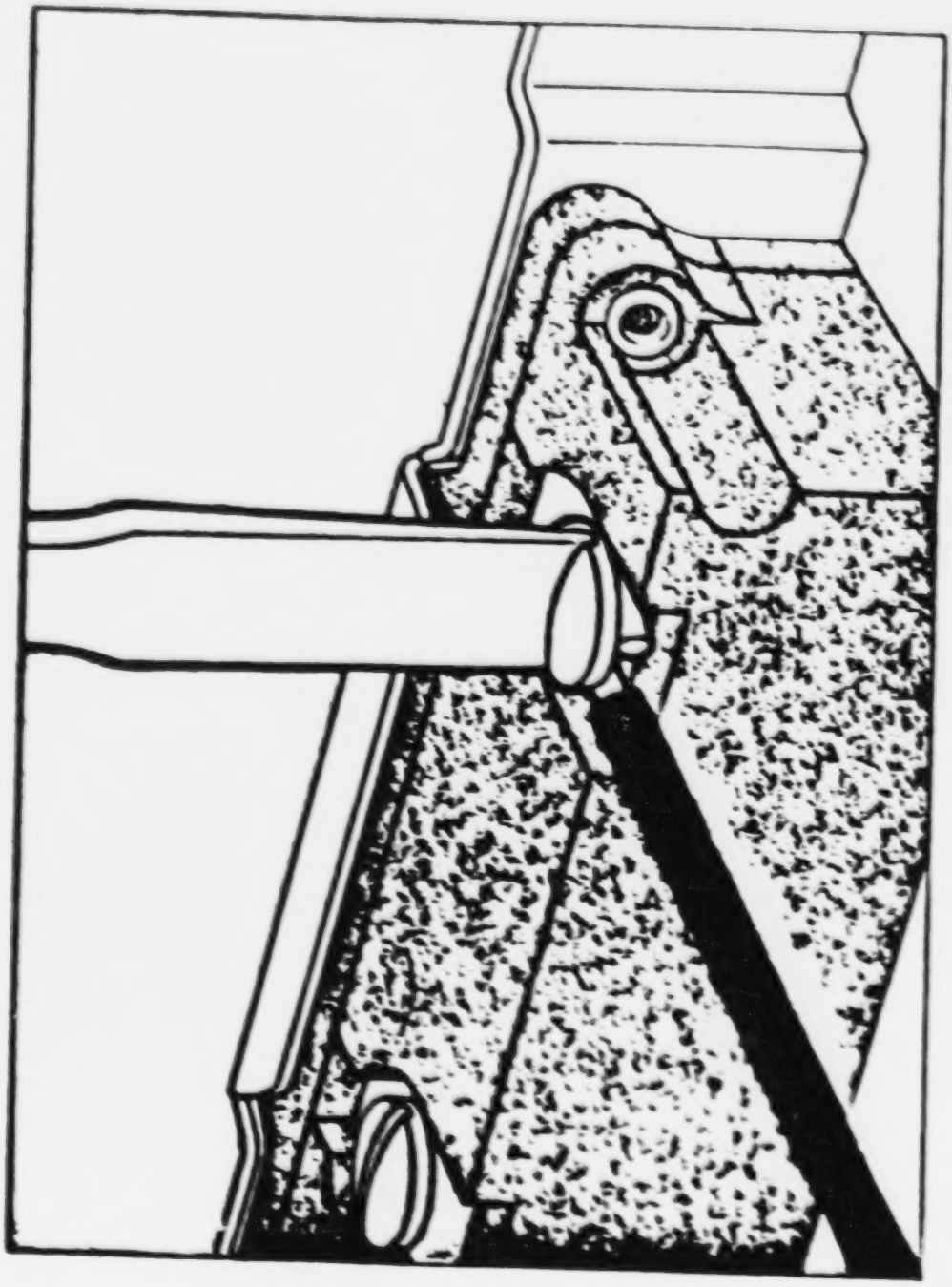

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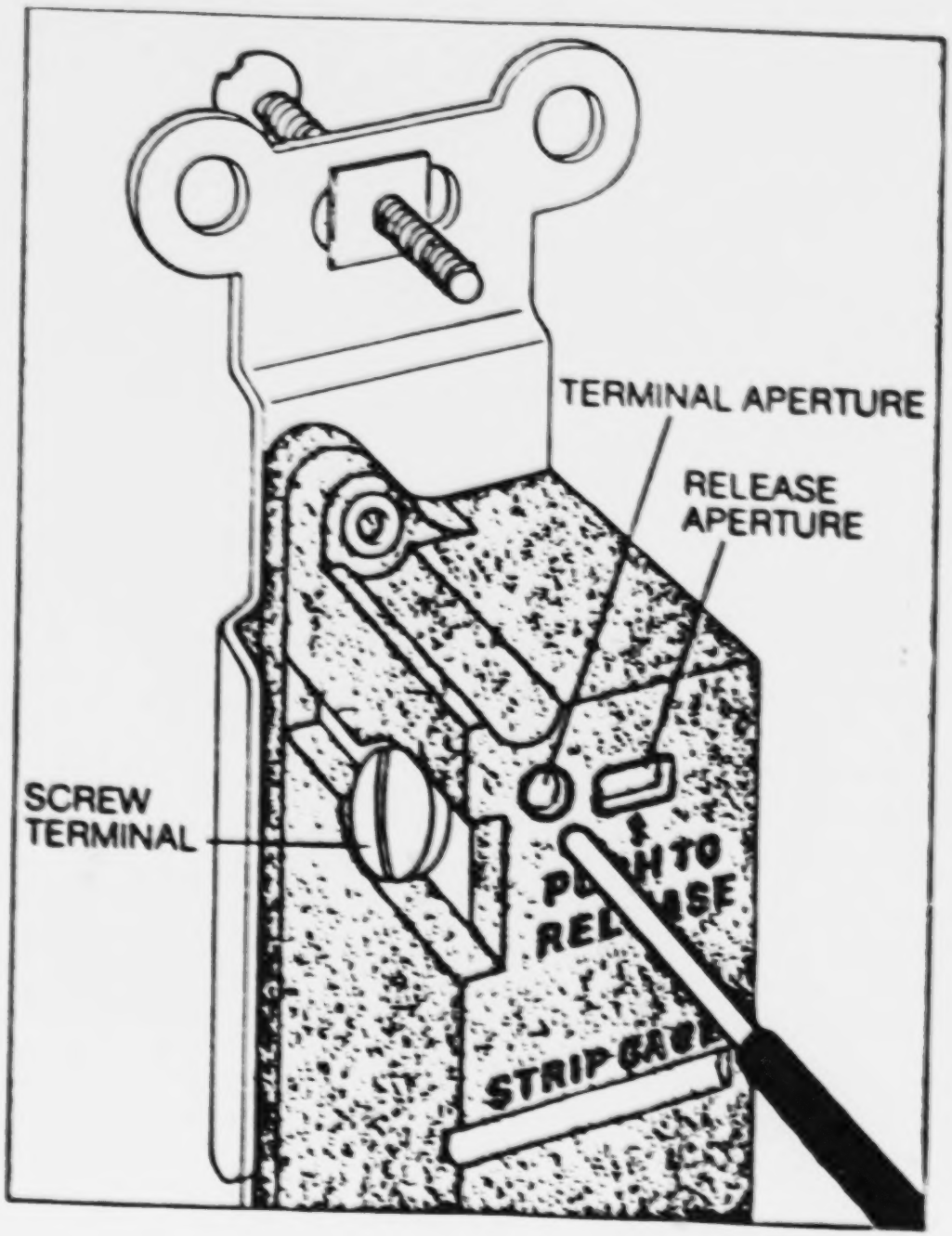
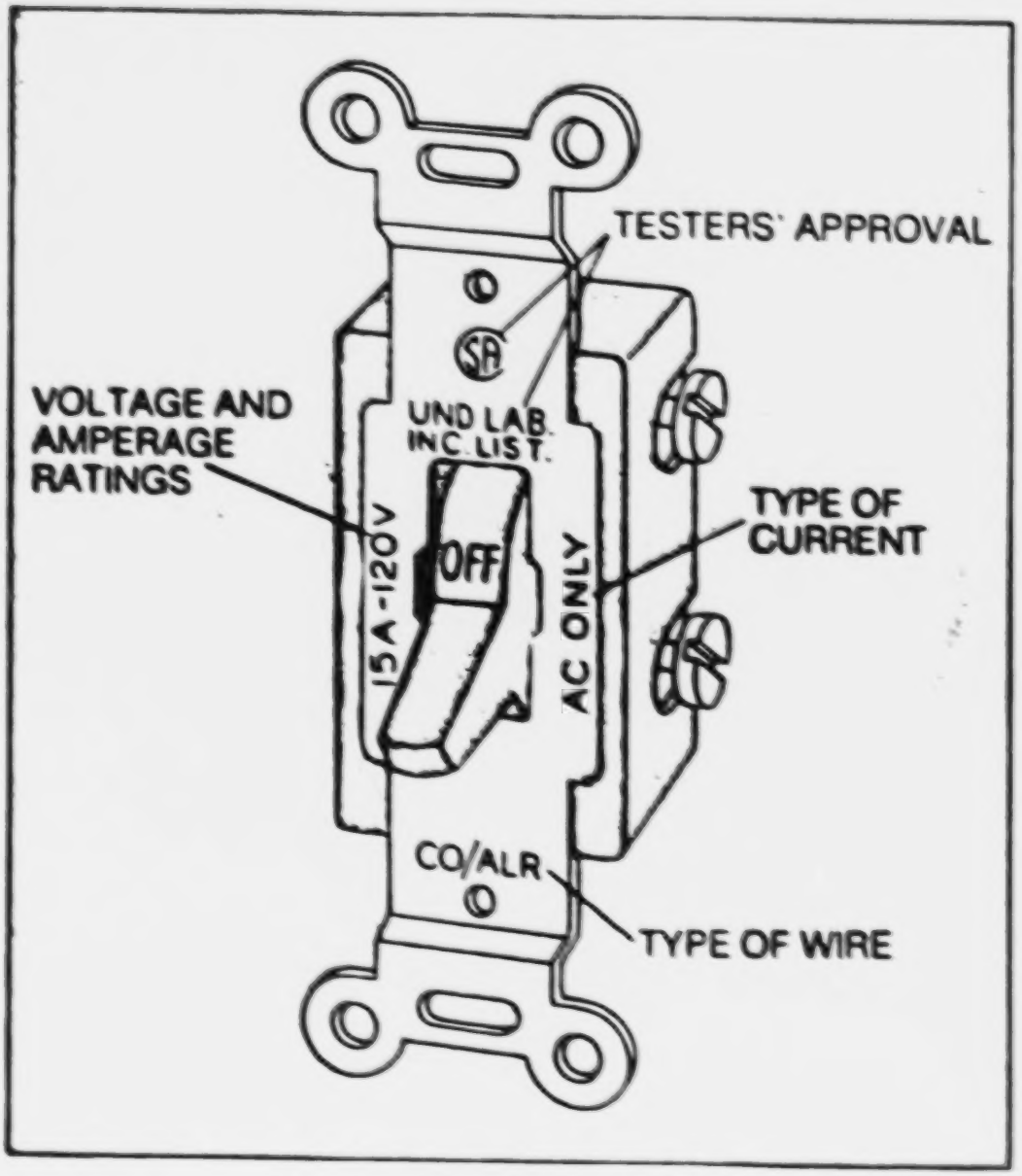

TERMINAL APERTURE
RELEASE APERTURE
SCREW TERMINAL


TESTERS' APPROVAL
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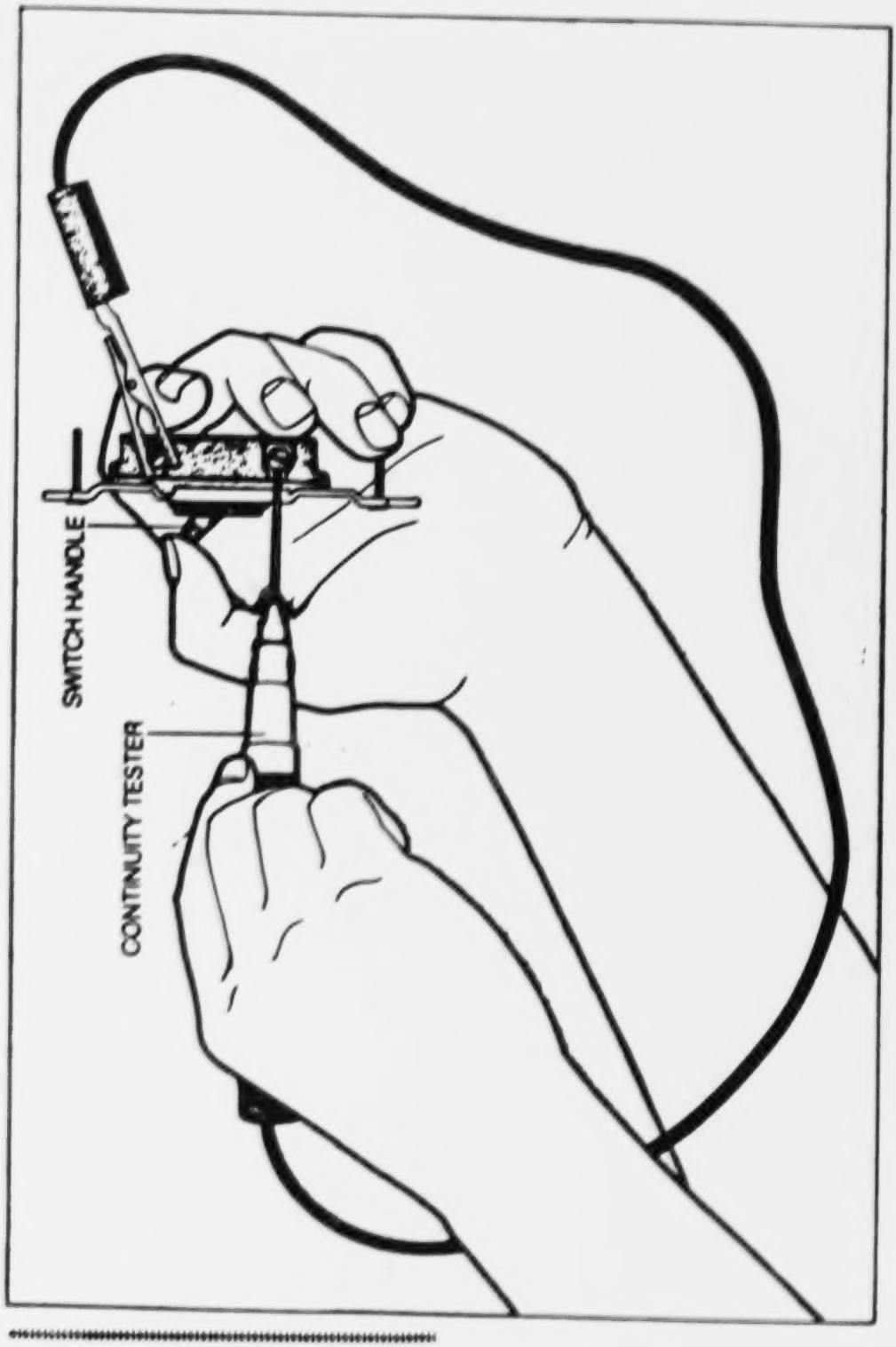
CO/ALR
TYPE OF WIRE



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